(b) If $m=-1/2, -1/4, -3/4, \ldots, -\frac{[2p-1]_{p=1}^{p=q}}{2q}$, $(1+\frac{1}{m})^m$ is imaginary.

(c) If $m=-1/2$, $e<e+\sqrt{(-1)}<\infty$.

(d) If $m=-1$, $\infty<e-\infty<-e$.

Therefore the given statements are proved true unless $0>m\overline{\gtrless}-1$. For case (iv) no general statement of relative magnitudes can be made on account of discontinuous functions.

376. Proposed by W. W. BEMAN, Professor of Mathematics, University of Michigan, Ann Arbor, Michigan.

If $\frac{(1+1/m)^m}{e}=1-a_1\frac{1}{m}+a_2\frac{1}{m^2}-a_3\frac{1}{m^3}+\ldots$, prove $na_n=\sum_{k=1}^{k=n}\frac{k}{k+1}a_{n-k}$, and compute $a_1, a_2, a_3, \ldots, a_8$.

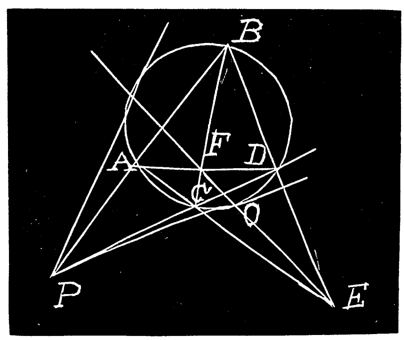
No solution of this problem has been received.

GEOMETRY.

400. Proposed by FRANCIS RUST, C. E., Pittsburgh, Pennsylvania.

Given a circle and a point P without; construct, *using the straight edge only*, the two tangents to the circle through P.

II. Solution by GEORGE W. HARTWELL, Hamline University, St. Paul, Minnesota.



Through P draw any two secants AB and CD, cutting the circle in A, B, C, and D. Join A and D, and A and C; B and D, and B and C. AC and BD meet at E, and AD and BC meet at F. Join E and F. EF is the polar of P. Then the points O and M in which the line EF intersects the circle are the points of tangency.

402. Proposed by H. PRIME, Boston, Mass.

The diameter of a hoop-shaped ring (or collar) is 24 inches at one edge and 28 inches at the other edge. A cross-section is a crescent with circular arcs of 120° and 60°, whose common chord is 4 inches long. Find its volume by elementary methods (without the use of calculus or the center of gravity).

Solution by H. E. TREFETHEN, Colby College.

Denote the given chord by AB, the axis of the ring by QQ, the arc of 120° by s, of 60′ by s'. Let ABC be an equilateral triangle. Complete the arcs s and s', and through A and C draw their diameters parallel to QQ.

Then we have $QA=12$, $QC=10$, $4=$radius of arc s', $4\sqrt{3}/3=$radius of arc s. $8\pi/3-4\sqrt{3}=$area of segment ABs', $16\pi/9-4\sqrt{3}/3=$area of ABs. $v=16.2\sqrt{3}.\pi/6=$volume generated by either segment revolving about its diameter, $2\sqrt{3}$ being the projection of AB on the axis.

Put V and V' for the volumes generated respectively by the segments ABs and ABs' revolving about QQ. Then apply the theorem: If a plane figure exterior to two parallel lines in its plane revolve in succession about each of them as axes, the difference between the volumes of the solids thus generated is equal to the area of the generating figure multiplied by 2π times the distance between the axes. Thus $V-v=(16\pi/9-4\sqrt{3}/3).2\pi.12$, $V'-v=(8\pi/3-4\sqrt{3}).2\pi.10$, $V-V'=16\pi(9\sqrt{3}-2\pi)/3=155.9113$ cubic inches$=$ required volume.

PROBLEMS FOR SOLUTION.

ALGEBRA.

380. **Proposed by J. K. ELWOOD, Superintendent Lucas Public Schools, Lucas, Kansas.**

A and B set out to walk around a cinder path a mile in circumference, and walk 3 hours, A walking 8 miles farther than B. Each reduced his rate one mile per hour at the end of the first hour, and again one mile per hour at the end of the second hour, his speed being otherwise uniform. They start in the same direction, but 12 minutes after A has passed B the third time he turns and walks in the other direction until 6 minutes after he has met B the third time, when he returns to his original direction, and overtakes B four times more. Determine their initial velocities. Illustrate by a time-table.*

381. **Proposed by S. A. COREY, Hiteman, Iowa.**

A, B, and C simultaneously make assignments of their property for the benefit of their creditors. The assets of A, B, and C were d, e, and q, respectively.

A's indebtedness as principal was a; A's indebtedness as surety for B was g; A's indebtedness as surety for C was h; A's indebtedness as surety for B and C jointly was i, (*i. e.*, B was surety for C, and A, in turn, was surety for B).

B's indebtedness as principal was j; B's indebtedness as surety for A was k; B's indebtedness as surety for C was l.

C's indebtedness as principal was m; C's indebtedness as surety for A was n; C's indebtedness as surety for B was p.

The law requires the surety to pay only such a portion of the debt as his principal cannot pay. What is the amount of the legal indebtness of each?

382. **Proposed by C. E. FLANAGAN, Wheeling, West Virginia.**

A few days ago I deduced the following formula for finding the value of the unknown quantity in a cubic equation having the form: $x^3+3A^2x=B$.

Let $C=\sqrt{\frac{2B}{A^3}+1}-1$. Then, $x=\frac{2B}{A^2(C^2+12)}+\frac{AC}{4}$.

* This problem is a variation of one by Todhunter. George H. Taber, of Pittsburgh, Pennsylvania, is responsible for it.